MARCH, 1928

ENTOMOLOGICAL NEWS

Vol. XXXIX No. 3

CHARLES ROBERT OSTEN SACKEN,
1828–1906

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PHILADELPHIA, PA.
THE ACADEMY OF NATURAL SCIENCES
Logan Square

Entered at the Philadelphia, Pa., Post Office as Second Class Matter.
Acceptance for mailing at the special rate of postage prescribed for in Section 1103,
Act of October 3, 1917, authorized January 15, 1921.

THE AMERICAN ENTOMOLOGICAL SOCIETY

ENTOMOLOGICAL NEWS

published monthly, **excepting August and September,** by The American Entomological Society.

Philip P. Calvert, Ph.D., Editor; E. T. Cresson, Jr., R. G. Schmieder, Ph.D., Ernest Baylis, Associate Editors; John C. Lutz, Business Manager.

Advisory Committee: Philip Laurent, J. A. G Rehn, Chas. Liebeck, J. Chester Bradley, Ph.D., Frank Morton Jones, John C. Lutz, Max Kisliuk, Jr.

The subscription price per year of ten (10) numbers is as follows:

United States and possessions . .	**$3.00**
Canada, Central and South America .	**3.15**
Foreign	**3.25**

Single copies 35 cents

ADVERTISING RATES: Full width of page. Payments in advance.
One issue, 1 in., $ 1.20, 2 in., $ 2.40, half page, $ 4.00, full page, $ 8.00
Ten issues " 11.00, " 20.00, " 35.00, " 70.00

SUBSCRIPTIONS. All remittances and communications regarding subscriptions, non-receipt of the NEWS or of reprints, and requests for sample copies, should be addressed to

JOHN C. LUTZ, 827 N. 66th ST., PHILADELPHIA, PA.

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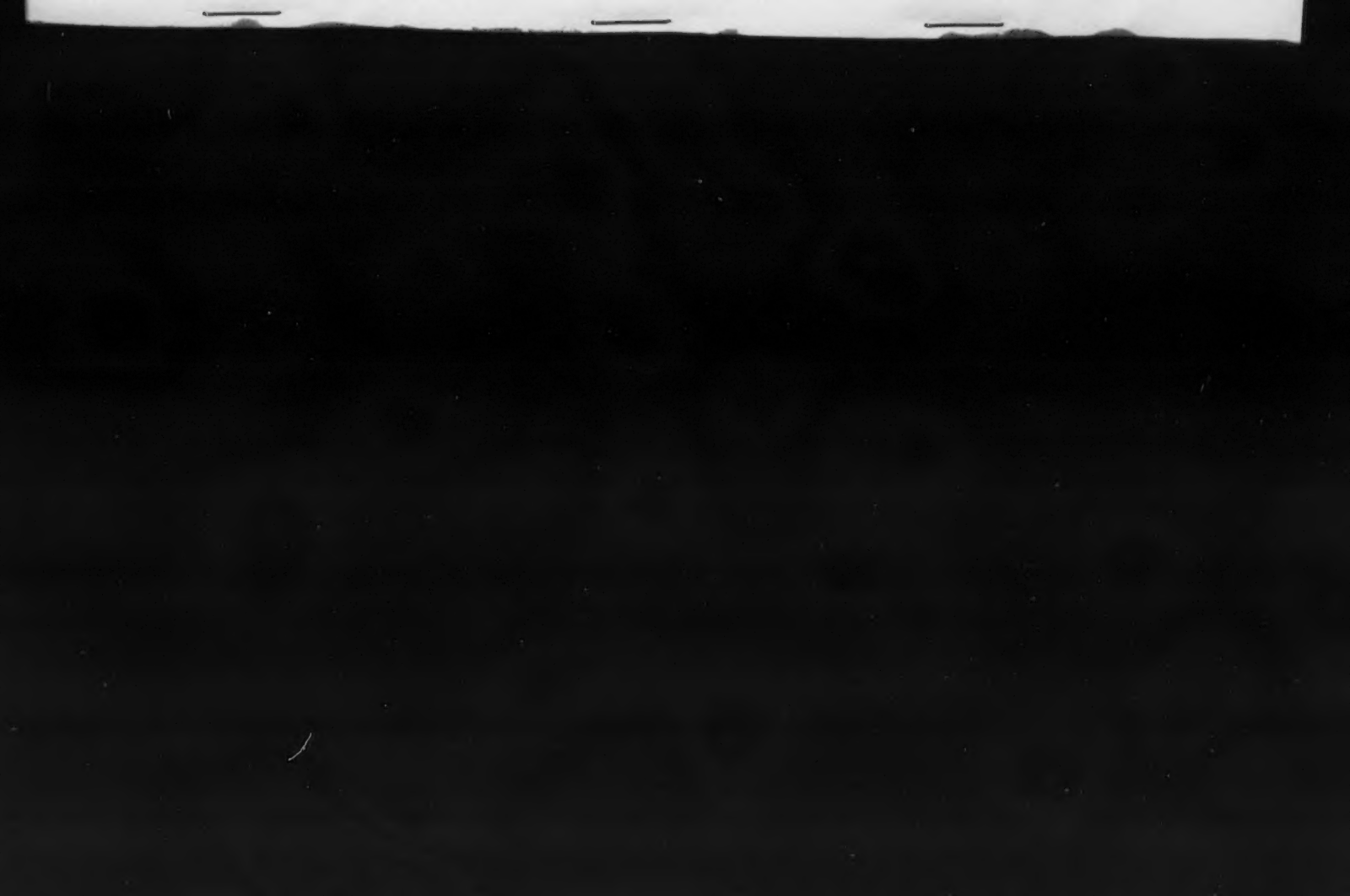

ENTOMOLOGICAL NEWS

VOL. XXXIX MARCH, 1928 No. 3

The Biotic Factors in the Environmental Resistance of Anthophora occidentalis Cress. (Hym.: Apidae; Dip., Coleop.).*

By CLARENCE E. MICKEL, University of Minnesota, St. Paul, Minn.

During the summer of 1925, Dr. Frances Long of the Alpine Laboratory, Manitou, Colorado, sent me specimens of both sexes of *Dasymutilla fulvohirta* Cresson which had been reared from the cells of the bee, *Anthophora occidentalis* Cresson. These specimens proved very interesting since they confirmed my decision regarding the identity of the two sexes of *D. fulvohirta*. The male was unquestionably this species, and the female was identical with those which had formerly been known as *D. californica* auct. and which I had assigned to *fulvohirta* on the basis of the data of geographical distribution. Since both had been reared from the same host, there could be little question as to their being the two sexes of the same species. I was interested, however, in rearing out additional specimens of this species from its host and in the fall of 1925, Mr. G. W. Goldsmith, of the Alpine Laboratory, was kind enough to send me a large number of the cells of *Anthophora occidentalis*. As far as rearing out additional specimens of the Mutillid was concerned the experiment was not a success for not a single Mutillid was secured from the entire lot; but the insects which eventually emerged from the cells of this bee revealed a more or less complex association, the components of which are held together by the species, *Anthophora occidentalis* Cresson. If the latter insect were removed from this relationship the whole association would break down and cease to exist; the integral parts of the association would then be either destroyed or dispersed to form

*Published with the approval of the Director as Paper No. 702, of the Journal Series of the Minnesota Agricultural Experiment Station.

new relationships with other organisms. The following notes are presented for the purpose of describing this association of insects and the relationships which exist within it.

Procedure.

The above mentioned shipment of *Anthophora* cells was received from Mr. G. W. Goldsmith early in the fall of 1925. In a letter dated September 3, 1925, Mr. Goldsmith says: "Large and interesting colonies are common about here—. Two weeks ago these colonies showed great activity and many of the nests contained very small larvae or eggs." On October 15th the cells were examined and 249 cells appeared to be inhabited. Each cell was placed in a shell vial, 20 x 80 mm., and the vial was stoppered with a plug of cotton. These vials were kept in the laboratory from October 15th until November 28th. The temperature of the room during this period varied between 72° and 78° F. On November 28th, the vials were placed in a refrigeration room for the winter. The temperature of this room varied between 30° and 40° F. during the time which the specimens remained there. On April 16, 1926, the vials were taken from the refrigeration room and placed in the laboratory and remained there from that time until the occupants emerged. The temperature of the laboratory during this period varied between 72° and 77° F. The first insect to emerge from the cells in this lot was a chalcid, *Monodontomerus montivagus* Ashmead, which emerged on May 12th. The first *Anthophora* emerged on June 10th.

A small number of cells were kept in the laboratory during the entire winter, and were not placed in the refrigeration room. The first *Anthophora* emerged from these on March 15th.

The Anthophora occidentalis Association.

Anthophora occidentalis Cress. is the key species to an association of insects which is composed of at least ten species. Nine of these are directly or indirectly dependent on the presence of *A. occidentalis* for their existence, either through the appropriation of the old cells of this bee for use as nests, or through the relationship of parasitism. Such an association

does not necessarily imply that if the key species were removed the dependent or secondary species would be exterminated, but that in such an emergency the latter must form some sort of a new relationship, and that the survival of the secondary species is dependent on their ability to form such new relationships. If a secondary species is capable of forming a new relationship with ease the removal of the key species presents a very small problem, but if the relationship with the key species is close and new relationships are formed with difficulty, then it may easily happen that the secondary species will be exterminated.

From the 249 cells which appeared to be inhabited when the material was received I succeeded in rearing 85 adult specimens of *A. occidentalis;* of these 55 were males and 30 were females. The percentage of emergence of adult *Anthophora* bees was therefore approximatly 34; and the percentage of cells which produced females of this bee was 12. The percentage of emergence of adult bees was in reality probably considerably less than these figures, because a large number of cells, the occupants of which had perished, were discarded when the material was received. On June 10, 1926, the first *Anthophora occidentalis* emerged from its cell. From that time until July 19, 1926, these bees emerged daily at the rate of from one to five per day. On August 17, 1926, it appeared that no more would emerge from the remaining cells, so each was opened and examined. Eighteen of the remaining cells contained adult bees which apparently were unable to make their way out of the cells and had therefore died. Four cells contained dead *Anthophora* larvae; apparently these four were not parasitized.

The insects which play the part of secondary species in the association are noted below:

1. OSMIA MANDIBULARIS. Cresson. A few of the cells contained in the original lot sent from Colorado differed from the others in the way in which the entrance to the cell was closed. The cells containing *Anthophora* larvae were all closed with the same sort of material of which the cell was constructed. These few cells, however, seemed to have the en-

trance plugged with a partition of greenish material. These were kept separate from the other cells and very late in the summer of 1926, two males and one female of *Osmia mandibularis* Cresson emerged from these cells. Hicks (1926) has given an account of the manner in which *O. mandibularis* uses the old *Anthophora* cells for its nests.

2. HOLOCHRYSIS n. sp. near CHRYSIS TOTA Aaron. (Det. S. A. Rohwer). One of the cells of which the entrance was plugged with the green material produced a chrysidid wasp. Since the cell was plugged in exactly the same manner as those which contained *Osmia mandibularis,* I have drawn the conclusion that this species is a parasite of the *Osmia* bee. Hicks (1926) states that he found *Chrysis densa* Cresson to be a very common parasite of *Osmia mandibularis.*

3. ANTHRENUS sp. When the cells of *A. occidentalis* were received from Colorado they were heavily infested with the larvae of *Anthrenus sp.* Since the material was collected in the field and sent directly to the author it seems probable that these larvae were present in the bee colony in nature. This supposition is confirmed by the observations of Hicks (1926) who found Anthrenus larvae in large numbers in colonies of *Anthophora neomexicana* Ckll. Whether these larvae feed only on the old pollen and dead insects found around the colonies or whether cells containing living larvae of the bee are entered and plundered is unknown. Certain of the cells in the lot of 249 which appeared to be intact when the rearings were started produced neither host nor parasite. When these cells were finally broken open and examined they were found to be empty and many of them contained *Anthrenus* larvae. There were 59 such cells.

4. MONODONTOMERUS MONTIVAGUS Ashmead. (Det. A. B. Gahan). The first insects which emerged from any of the 249 cells proved to be specimens of this large green chalcid. On May 12, 1926, 26 days after the lot of cells was removed from cold storage, eleven specimens of this species emerged from a single *Anthophora* cell. On the following day this parasite had emerged from ten additional cells. Altogether twenty-one cells proved to be parasitized by this chalcid and a

total of approximately 415 specimens emerged from these twenty-one cells. About 94 per cent of this number were females.

5. PSEUDOMELECTA MIRANDA (Fox). This bee appears to be one of the minor members in the association with *A. occidentalis*. Only five specimens were reared from the 249 *Anthophora* cells. The first specimen of this bee emerged on July 2, 1926; two emerged on July 9, and the last two on July 19. All of these were females. Hicks (1926) has also reared this species from *A. neomexicana* Ckll. but did not find it at all common. In August, 1925, Dr. Frances Long sent me several specimens of this bee which she had reared from *A. occidentalis* taken near Colorado Springs, Colorado.

6. DASYMUTILLA FULVOHIRTA (Cresson). The *Anthophora* cells were originally obtained from Colorado with the idea of rearing out this species and obtaining further information regarding it, but no specimens were obtained from the 249 cells. In August, 1925, Dr. Frances Long sent me a male and female of this species which she had reared from cells of *A. occidentalis,* so that it is definitely known that *D. fulvohirta* is a member of the association.

7. SPOGOSTYLUM DAPHNE O. S. (Det. C. T. Greene). On July 3, 1926, a bombyliid fly belonging to this species emerged from one of the *Anthophora* cells. It is apparently not a common parasite of *A. occidentalis* since only one specimen was reared from the 249 cells. Frison (1922) records the rearing of *Spogostylum albofasciatum* Mac. from the cells of *A. abrupta* Say and states that it is a true parasite of the latter. Rau (1926) records the presence of the adults of *S. fur* around the colonies of *A. abrupta* but did not determine that it actually parasitized the latter.

8. LEONIDIA ANTHOPHORAE Mickel. Eight males and seven females of this species were reared from the cells of *A. occidentalis*. The first specimen of this species emerged on May 20, 1926. Others emerged at intervals until the last one on July 6. This species ranks next to *Monodontomerus montivagus* Ashmead in the number of host individuals destroyed.

9. HORNIA MINUTIPENNIS Riley. Four males and three females of this meloid beetle were reared from the *A. occidentalis* cells.

10. NEMOGNATHA LURIDA Lec. A few cells of *A. occidentalis* were kept in the laboratory all winter. By May 13, 1926, it appeared that no more emergence might be expected from this material. At that time all the remaining cells in the lot were opened and examined. In one of these an adult specimen of *Nemognatha lurida* Lec. was found. It was dead and apparently had been unable to make its way out of the cell after reaching the adult stage. No specimens of this beetle emerged from any of the cells in the lot of 249.

DISCUSSION.

Unfortunately the lack of exact data regarding the relationships existing between *Anthophora occidentalis* and the insects associated with it has not permitted any definite conclusions to be drawn concerning the effects resulting from these relationships. It is clear, however, that the relationships which exist here are of the same sort that exist between an injurious insect pest and its associated parasites. On account of the large number of insects which compose the *Anthophora* association and the ease with which it could be investigated in its native habitat it offers an opportunity to analyze a situation in which a host insect is present together with numerous biotic factors in its environmental resistance. This sort of a situation exists in every case where an effort is made to control an injurious insect pest by introducing several or numerous parasites from its native habitat. An analysis of the biotic factors in the environmental resistance of *Anthophora occidentalis* would undoubtedly indicate that certain of the factors taken by themselves are more effective in controlling the numbers of this bee, than when present in combination with other factors; that a combination of factors is sometimes less effective as environmental resistance, than the individual factors when taken alone. Fiske (1910) has already called attention to this in a discussion of superparasitism, and the case of the parasites of the Mediterranean Fruitfly in Hawaii, (Pember-

ton and Willard 1918) affords an example of an injurious insect pest in an association analagous to that of *Anthophora occidentalis.*

A. occidentalis offers an excellent opportunity for the investigation of the way in which biotic factors operate as environmental resistance. It is practically certain that in this case *Monodontomerus montivagus* Ashmead, *Pseudomelecta miranda* (Fox), *Dasymutilla fulvohirta* (Cress.), *Spogostylum daphne* O. S., *Hornia minutipennis* Riley, *Leonidia anthophorae* Mickel and *Nemognatha lurida* Lec. are all factors in reducing the numbers of *A. occidentalis.* To what extent they make up the environmental resistance, whether they operate independently or in competition with one another, the exact effect produced when any one of them is removed from the association, and the exact effect produced when additional factors are added to the association, are all problems which it is important to investigate. The solution of these problems would undoubtedly throw considerable light on similar problems involved in the biological control of injurious insect pests. The ways in which biotic factors operate as environmental resistance in the case of one insect would certainly indicate the ways in which these same factors operate in the cases of other insects. *A. occidentalis* is especially suitable for such a study because several biotic factors are known to be involved. It is certain that biotic factors operating as environmental resistance produce entirely different effects when several such factors are present than are produced when only a single one is acting. This bee is also especially adapted to such a study on account of its gregarious habits, large numbers being found within a very small area in the soil, and therefore great numbers of them may be amassed with comparative ease. They are easy to carry over winter in the laboratory and can be handled in such a way that exact data, which may be used in mathematical computations, may be collected readily.

Whether the number of *Anthophora* bees produced in a colony remains constant from one year to another, or whether there is a fluctuation in numbers cannot be definitely determined from the data available; but as a general rule the greater

the number of factors which operate against the continued existence of a species, the more constant the number of that species will be from year to year. Or in other words, the greater the number of factors making up the environmental resistance of a species, the more constant in number will be the population of that species from year to year, and the lower the number of the population will be in relation to the biotic potential of the species. An environmental resistance composed of numerous factors tends to create an equilibrium in the population of the species against which it operates, while an environmental resistance composed of few factors tends to create great fluctuations in the population of a species from one year to another. (For a discussion of biotic potential and environmental resistance the reader is referred to Chapman, 1926, pp. 143-164.)

While the exact value which should be attributed to each of the biotic factors in the environmental resistance of *A. occidentalis* is not known, some idea of their relative value is to be had. For example the exact roles which *Osmia mandibularis* and *Holochrysis* n. sp. play as biotic factors cannot be demonstrated at present but it seems fairly evident that theirs is a very minor role. *Spogostylum daphne* and *Nemognatha lurida* are probably somewhat more important but are nevertheless apparently quite minor factors. The value of *Anthrenus sp.* as a biotic factor can only be determined when it is known whether it attacks *A. occidentalis* directly and destroys the larva, or whether it is a scavenger feeding only on old pollen and dead insects. *Dasymutilla fulvohirta* may be an important biotic factor although it was not reared from the 249 cells in question. *Hornia minutipennis* and *Leonidia anthophorae* are important biotic factors. The habits of the two species are probably very similar, so that one may properly assume that when both are present in the same environment they are in direct competition with one another. What the effect on one would be if the other were removed from the environment, and the ultimate effect on *A. occidentalis* would be very interesting problems to investigate. Are the combined efforts of *H. minutipennis* and *L. anthophorae* more effective in reducing

the numbers of *A. occidentalis* than the efforts of either species by itself? *Monodontomerus montivagus* ranks very high as a biotic factor in this association while *Pseudomelecta miranda* apparently may have less value than *Hornia minutipennis*. The value assigned to *P. miranda*, however, would depend entirely on the relationship which may be found to exist between it and *M. montivagus* and *A. occidentalis*, the possibilities of which are suggested below.

The figures given above regarding the ratio of the sexes of *M. montivagus* agree very closely with the data cited by Rau (1922, 1926) for the same, or a very closely related species, in the nests of *A. abrupta* Say. On the other hand, Hicks (1926) found the proportion of the sexes almost reversed in the one cell which he examined, eleven males and three females having emerged from the cell. Whether *M. montivagus* is a primary parasite of *A. occidentalis*, a hyperparasite, or both, does not seem to be definitely settled. Rau (1912, 1926) states that it is parasitic on *A. abrupta;* Hicks (1926) states that he found it parasitic on *Pseudomelecta miranda* (Fox), which is itself a parasite of *A. occidentalis*, and that it was also parasitic on *A. occidentalis*. Practically nothing is known about the life history of *M. montivagus*. Rau (1926) states that there are two generations per year, but further than that the insect does not seem to have been investigated. How it gains entrance to the cells of the bees, how and where it lays its eggs, how the larva develops, the possibility of the insect being polyembryonic and parthenogenetic, whether it is restricted to *Anthophora* bees in its parasitic relations, or whether it may be both a primary parasite and a hyperparasite, and whether one species of *Monodontomerus* parasitizes several species of *Anthophora*, or whether each species of the latter has its own particular species of *Monodontomerus*, are all questions which would bear investigation and all of which would contribute important information regarding the function of this chalcid as a biotic factor in the environmental resistance of *A. occidentalis*.

As stated above Hicks (1926) thinks that *Monodontomerus*

montivagus is a parasite of *P. miranda,* but in the rearings made by me there was no evidence to lead me to believe that any such relationship as this existed. If Hicks is correct, a question immediately arises as to the part played by this species in the environmental resistance of *A. occidentalis.* Is the scarcity of *P. miranda* due to the hyperparasitism of *M. montivagus?* If it is, what effect would be produced if the latter were removed from the environment? Would *P. miranda* then increase in numbers and be a more effective factor in the environmental resistance of *A. occidentalis* than *P. miranda* and *M. montivagus combined,* or would it remain constant and the numbers of *A. occidentalis* increase?

All of the questions which have been raised in the above paragraphs may seem to have only academic interest in the case under consideration, but they are certainly of the highest importance when taken in connection with the introduction of parasites from foreign countries for the control of injurious insect pests. All of these questions can be solved with mathematical certainty and the failure to investigate them when an important insect pest is concerned is nothing short of gross negligence.

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A New Corethrella from Panama (Diptera : Culicidae).

By HARRISON G. DYAR, U. S. National Museum, Washington, D. C.

Corethrella blanda, new species.

Mesonotum light brown, abdomen blackish above. Legs pale brown, uniform in the female, a little more diversified in the male, the tibiae appearing paler at their tips. Wings pale brown, a broad smoky band across the middle, formed by the darkening of the hairs on the veins.

Male hypopygium. Side piece conical and furnished with several stout spines on the inner side; of these a strong central one arises from a large tubercle, and there are six other less strong ones, scattered over the inner surface and not arranged in a line. Clasper as long as the side piece, rather thick, simple. Mesosome very short, composed of two stout approximated cones. Male antennae 16-jointed, tori very large; joints 4 to 10 have the hairs very long, not arising in whorls, but throughout the slender joint, though the basal hairs are longest; hairs shorter on joint 11, and thence shorter and fewer to tip.

Bred by Dr. D. P. Curry from larvae in a shaded grassy pool at Las Sabañas, Panama, May 28, 1927. "The larvae are cannibals. When first put in the tube together, they seized and devoured each other; but the survivors of the first attack lived together peaceably for weeks afterward."

Larva with the head transverse, the front conically produced, but moderately so, the cone not as long as the length of the rest of the head and only about half as wide. Antennae inserted at the tip of the cone, folded backward in a groove when at rest, with three long spines at tip not of uniform lengths. Front margin of labium with ten stout teeth. Mandibles curved in a semicircle, with three stout teeth on apical aspect and four short ones at tip. Tube stout, flat, about twice as long as wide. Eighth segment with an encircling plate; laterally behind it on each side are four black hairs arranged in two groups. This plate reaches the middle of the sides and is supplemented by a small quadrate one ventrally. Sixth and seventh segments with round dorsal plates. Anal segment longer than wide, with six dorsal hairs, eight ventral, and a single lateral one, much smaller than the others. Anal gills small, pointed, not as long as the width of the segment.

Pupa with stout thorax and small tapering abdomen. An angularly trilobed structure on each side represents the air-trumpets; a solid flat plate, one angular lobe pointing forward,

another laterally, and the largest one posteriorly. Abdominal segments produced laterally and posteriorly, granular, and with a long terminal hair directed backward; the two posterior horns end in a stout thorn, and have a small lateral hair.

Two males and one female (type male on a slide), Las Sabañas, Panama (D. P. Curry), type No. 40517 U. S. National Museum.

The Entomology of Central Siberia.

By T. D. A. Cockerell.

With headquarters at Irkutsk, in the hospitable rooms of the Geological Committee, my wife and I have explored the surrounding country in several directions. First we went to Ust Balei on the Angara, to search for fossil insects in the Jurassic beds; then to the Biological Station of the University of Irkutsk, on Lake Baikal; later to Archan, 105 versts west of the southwest corner of Lake Baikal, at an elevation of 900 meters. In the last week we have collected in localities near Irkutsk; Smolenschina and Kychtak. The insect fauna of this whole region is strictly Palaearctic. The extensive deserts to the south have prevented any migration thence of Chinese types. The fauna is an impoverished one compared with that of the Maritime Province, which we visited four years ago. Very few moths come to lights at night, and the butterflies are not especially numerous or striking.

The common species belong to *Aglais, Erebia, Melitaea, Colias, Leptidia* (these are the common whites instead of *Pieris*), *Lycaena,* with several other satyrids and a number of ordinary small skippers. *Papilio* and *Parnassius* are occasionally seen, and I have caught a very nice *Chrysophanus* at Smolenschina. A fine *Grapta* was found at Archan. The burnets (*Zygaena*) are common, apparently of two species. Among the Coleoptera the Cerambycidae are preeminent with very many species, but nearly all are small, principally of the *Leptura* type. Buprestids are occasional. *Mordella* sits on the flowers as in Colorado. I have two handsome species of Meloidae. Carabidae are not abundant. These are merely general impressions; no

doubt intensive collecting over a longer period would reveal many species. *Cetonia* serves to remind us, like the burnet moths, that we are in the Palaearctic Region. The ants are very commonplace: *Formica rufa* with its characteristic nests, *F. fusca* under stones, *Camponotus* in the forest, and other circumpolar types. No Mutillidae have been seen. Ichneumonidae are not so numerous as in Colorado and Chalcidoidea are rarely met with. There are some extremely beautiful species of the Chrysididae. Diptera abound with many Tachinidae, Asilidae, etc., and more mosquitos than we desire. Orthoptera include some rather large and handsome forms. A common small grasshopper is *Gomphocerus sibericus,* looking just like our Colorado species. Mr. Ivan Rultsoff tells me that it is a very great pest; it recently appeared in vast numbers, causing a loss of about a million roubles. This is astonishing because in Colorado I have supposed *Gomphocerus* to be harmless. The Hemiptera, so far as seen, are very like those of the Rocky Mountains. Bees are abundant and I have made a fine collection. Except the *Bombus* which have been intensively studied by Skorikoff and others, the bees of this region are little known.* Thus I expect to find a good many novelties though I feel sure many of the species are identical with European ones. There is nothing in common with the desert fauna, and so far as I can see on casual inspection, few species are the same as those of the Maritime Province. As bees are found on flowers, it might be supposed that it would be easy to exhaust the fauna of a region, at least as represented during the season visited. Our experience shows that this is not at all the case. The poorest locality we found was Archan, the richest Smolenschina near Irkutsk. At Smolenschina, where we were kindly taken by Mr. Ivan Belikoff, secretary of the Geological Committee, we found a small flowery spot, a few hundred yards in each direction, extra-

*Long ago Radoszkoski recorded the following *Bombus from* Irkutsk: *B. terminalis* L., *B. distinguendus* Mor., *B. baicalensis* Red., *B. equestris* Fab., and var. *mucidus* Gerst. Friese makes *B. equestris* a subspecies of *B. silvarum* L. and *baicalensis* a synonym of *equestris.* Sladen shows that *B. distinguendus* is a good species, not a race of *B. subterraneus.*

ordinarily rich in bees, while few were to be found in other places nearby. But the remarkable thing is that after collecting one day, we returned after a few days, and from the same flowers (*Geranium, Tanacetum, Achillea, Campanula,* etc.) obtained a new set, in many ways different from the first. Thus on the first trip a neat little *Nomada* was very abundant; on the second we got none, but only a single specimen of another *Nomada*. On the first trip we got two specimens only of *Nomia*, on the second they were abundant. It was on the second trip that a strange looking bee was netted and as I took it out it stung viciously, and I thought had a peculiar feel. I was curious enough to inspect it with the lens as soon as it was quiet in the bottle, and was delighted to see a *Melecta diacantha* Eversman, which has a *Crocisa*-like scutellum. At Kychtak I was pleased to find a couple of specimens of *Dioxus*, another parasitic genus. Taking the bee fauna of the region as a whole, the following are general impressions. *Hylaeus* is not very common, far less so than in the Maritime Province where I got a long series of species, all new. *Colletes* is abundant at least in individuals. *Halictus* is surprisingly poor in species and even in individuals; we have more *Colletes* and many more *Andrena* than *Halictus*. One species of *Halictus* is of gigantic size. *Andrena* is well represented; a very large and handsome species was taken at Smolenschina. *Sphecodes* is about as usual. *Megachile* abounds and there are several species of *Anthopora*. I got only one Eucerine, one *Melecta* and one *Panurginus*. The *Panurginus*, is, I am nearly sure, *P. niger* Nylander, the type of the genus, described many years ago from Siberia and not seen since. *Osmia* is rare, all black. We have a few *Anthidium* and one fine little *Dianthidium*. Several other genera are represented each by one or a very few individuals. Several of the genera are certainly new to Siberia. To-day (Aug. 22) we start for Tashkent in Russian Turkestan.

Sugaring for Catocala Moths in New Hampshire, August-September, 1927 (Lepid.: Noctuidae).

By MARGARET M. CARY, Germantown, Philadelphia, Pa.

This summer a group of boys and girls and I had had such good luck catching Sphingidae over larkspur and phlox in the early evening that we decided to lengthen our collecting day by sugaring for Catocalas. Our cottage is located near Lake Sunapee and is about 1300 feet above sea level. The country is hilly and wooded; but we live in an open meadow stretching to the lake. Surrounding this meadow are a good many different kinds of trees and on two sides there are large tracts of woodland. We had read about sugaring, but had never been successful and we determined to get the right mixture for the bait and to do it for many nights in succession.

For the benefit of others who have tried different baits, I will give the exact formula which we used. We bought cheap beer, opened it into a large crock, putting in one yeast cake to two bottles of beer, covered it up tight and left it in a warm room. Then we took apples and crushed them, adding some brown sugar and setting them out in the sun to ferment. Early each morning we put the following ingredients together in a bucket: 1 cup of the yeast-beer, ½ cup brown molasses, 1 tablespoon rubbing alcohol, 2 lbs. brown sugar, 1 cup crushed and fermented apples and 1 yeast cake.

By evening this mixture had a very strong smell and at six o'clock (standard time) we began painting the trees around the meadow. We painted five white pines, two white birches, two shaking aspens, two ash trees and four apple trees and stumps. These trees were in three main groups, so that there was a strong odor in each locality. At seven we repainted and often again at nine o'clock. We lighted our lantern, making the rounds every half hour from seven-thirty to ten-thirty or eleven o'clock. Catocalas alight on the sugar in such a way that the bright under wings show. They are very nervous and if the slightest shadow crosses the tree where they are resting, they fly away immediately. It therefore takes

great skill to hold the lantern in such a way that its light falls full and steadily on the sugar, and does not blind the person who is to do the catching. We went single file, I with the lantern in the lead, the boy with the net following, and the boys and girls with the cyanide jar and collecting case brought up the rear. Absolute quiet was observed.

Small Catocalas, like *crataegi, antinympha* and *ultronia,* we caught in the cyanide jar, placing it slightly beneath the insect, as Catocalas always dart down when starting to fly, and if the boy with the jar missed it, the boy with the net caught it in flight. For all the larger Catocalas, however, we found the net more satisfactory than the jar. My nephew, being very expert with the net, practically never missed one, and I, myself, caught two Cerogamas in the net at one swoop one night after the children were in bed. We began sugaring on August 2nd, keeping it up until September 12th every night except in the pouring rain or on nights when the wind blew furiously. Catocalas seemed to like spitting rain and dampness, preferring warm, dark nights to those when the moon was bright and the air cold. On three different nights we caught eleven Catocalas, on one other night we caught ten, and in all we got a hundred and sixteen, among which were at least sixteen species and varieties. We caught two forms of *unijuga,* two or three varieties of *briseis,* two varieties of *relicta, concumbens, parta, ultronia, praeclara, crataegi, ilia* form *conspicua, cerogama, paleogama* form *phalanga,* and *antinympha. Unijuga, briseis, relicta, cerogama,* and *concumbens* were very much more common than the others, and most of them were caught between eight and nine in the evening. As Holland says in his "Moth Book", "No sport could exceed this". It requires skill and patience and is full of a variety of excitements including skunks, who also delight in the sugar!

Two New Anthocorids and a New Microphysid from Florida (Heteroptera).

By W. S. BLATCHLEY, Indianapolis, Indiana.

Since my work on the Heteroptera of Eastern North America appeared a new species of the family Anthocoridae, belonging to a genus not before known to be represented in this country, has been taken in Florida and another undescribed species of the same family was referred to the wrong genus in that work. A new species belonging to an apparently new genus of the family Microphysidae has also been taken. These have, through the kindness of Mr. W. E. China, all been compared with specimens in the British Museum. They are therefore characterized and named in this paper. The types of all three are in my private collection.

The genus *Asthenidea* Reuter (1884) is closely allied to *Cardiastethus* Fieber (1860), differing mainly in the less deeply emarginate base of pronotum, the more shallow transverse groove of scutellum, and by the absence of a hamus in the cell of the inner wings. It is not very strange, therefore, that, without specimens for comparison, I ascribed to the former genus, on page 631 of the Heteroptera of Eastern North America, a species which I called *Asthenidea pallescens* Reuter, but which, according to China, is an unnamed species of *Cardiastethus,* allied to *C. tropicalis* Champ., a Guatemalan species. I therefore give it the new name

Cardiastethus flaveolus sp. nov.

Elongate-ovate. Color above and beneath a nearly uniform pale brownish-yellow, the head and thorax shining, the elytra duller with numerous scattered inclined rather long yellowish hairs; inner half of cuneus usually in great part fuscous; membrane pale dusky hyaline, slighty iridescent. Beak scarcely reaching front coxae, its apical joint slender, acute. Eyes relatively large, subglobose, coarsely facetted, narrowly separated beneath. Antennae slightly longer than head and thorax united, thickly pilose; joint 1 reaching tip of tylus, 2 three times as long as 1, visibly thickened apically; 3 and 4 slender, tinged with fuscous, each about two-thirds the length of 2.

Pronotum subtrapezoidal, its base less than twice as wide as apex, very broadly and deeply concave; disk with a wide median transverse impression, the callus of front lobe almost smooth, transversely convex, the hind lobe depressed, finely transversely rugose-punctate; hind angles thickened, slightly prolonged, the side margins in front of them almost straight, finely carinate. Scutellum with base broadly exposed, very finely punctate, disk with a distinct postmedian transverse impression, its apical portion more coarsely and distinctly punctate. Elytra elongate-oval, passing tip of abdomen by one-third the length of membrane; clavus strongly declivent toward corium, beset with three irregular rows of very fine punctures; sides of elytra subparallel to base of cuneus, thence broadly curved into the rounded tips of membrane. Osteolar channel long and curved. Length 2.5—2.8 mm.

Described from seven specimens taken at Royal Palm Park, Florida, in December and April by sifting vegetation in low damp places and by beating the dead fallen leaves of royal palm in the dense hammock on Paradise Key. *Type* a male taken at the Park December 18, 1924. According to China my specimens "are very close to, if not identical with, three specimens in the British Museum from San Geromino, Guatemala, which were wrongly identified by Champion as a variety of *C. tropicalis* but which are specifically distinct from the typical form of that species." Champion, after his description of *tropicalis,* mentions these specimens very briefly as follows[1]:

"Var. Above and beneath testaceous, the elytra more sparsely punctured."

ELATOPHILUS Reuter, 1884, 56, 61.

This genus belongs to the subfamily Anthocorinae, as treated on page 633 of the Heteroptera, and differs from *Anthocoris* in having the head more prolonged with eyes much more distant from the front margin of pronotum, the base of pronotum feebly but distinctly punctate; hind coxae widely separated, with apex of metasternum truncate and extending between them. In *Anthocoris* the eyes are subcontiguous to apex of pronotum, and the hind coxae are narrowly separated

[1]Biol. Cent. Amer. (Hemip.—Heterop.) II, p. 331.

or contiguous, the apex of metasternum narrowly rounded between them.

Elatophilus pinophilus sp. nov.

Elongate-oval, almost glabrous. Head, pronotum and scutellum reddish-brown, shining, the tylus and occiput somewhat darker; elytra pale dull yellow, the cuneus and tip of clavus and a faint cloud near apex of corium fuscous; membrane a uniform whitish hyaline; sterna and legs pale brownish-yellow, ventrals fuscous-brown. Head porrect, longer than its width across eyes; tylus stout, cylindrical, its apex truncate. Antennae stout, as long as head and pronotum united; joint 1 and basal half of 2 yellow, 1 just reaching tip of tylus; 2 with apical half fuscous, two and a half times as long as 1, visibly but feebly thickened toward apex; 3 and 4 fuscous, oblong-fusiform, finely pubescent, 3 scarcely as long as 1, 4 one-fourth longer than 3, obtusely pointed. Pronotum subtrapezoidal, twice as wide at base as apex, hind angles somewhat prolonged, subacute; sides in front of them feebly sinuate and convergent from base to apical third, thence rounded to apex; disk with a deep, entire postmedian transverse impression, front lobe smooth, convex and with a faint median impressed line, hind one flattened, minutely shagreened. Mesoscutum broadly exposed. Elytra slightly surpassing abdomen, almost invisibly punctate, very finely pubescent. Abdomen of female broadly oval, narrowed at base. Length 2.8 mm.

Type a female, taken April 14, 1927, at Royal Palm Park, Florida, by beating the tops of a dead and fallen pine. It apparently belongs to the subgenus *Euhadrocerus* Reut., characterized by having joint 3 of antennae not longer than 1, with beak scarcely surpassing front coxae. This subgenus is represented by a single heretofore known species, *Elatophilus* (*Euhadrocerus*) *crassicornis* Reuter, described from Algeria. That is piceous-black, with membrane infuscate. No member of the genus *Elatophilus* has previously been taken in this country.

CHINAOLA gen. nov.

This genus differs from *Mallochiola*[2] Bergroth, as char-

[2]I was unable to borrow in time a specimen of *Mallochiola gagates* from its authors. The differential characters between the two genera are therefore deduced from their description and figures of *Mallochiola* (*Idiotropis*) *gagates* in Bull. Brooklyn Entom. Soc. XIX, 1924, p. 70 and fig. 2, pl. I.

acterized on page 658 of the Heteroptera, the only other genus of the family Microphysidae known from North America, in having the front margin of pronotum truncate not concave; elytra narrowly oval with sides subparallel from just behind humeri to base of cuneus, not broadly oval with sides rounded as in *Mallochiola*, and membrane with two veins projected backward from a ridge near base to the middle of disk, the outer one bent angularly at basal third. The genus is named in honor of W. E. China, the efficient Hemipterist of the British Museum, who has given me much aid in my studies of eastern American Heteroptera.

Genotype: *Chinaola quercicola* sp. nov.

Chinaola quercicola sp. nov.

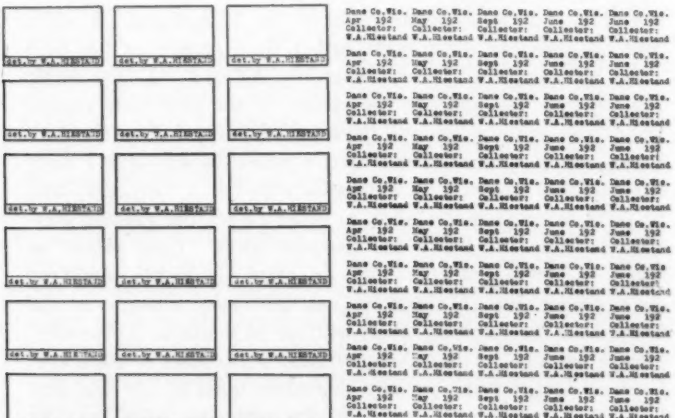
Oblong-oval. Head black, strongly shining, glabrous; pronotum and scutellum black, less shining; clavus and basal two-thirds of corium white; apical third of corium fuscous, cuneus and broad median bar of embolium black; base and apex of embolium white; membrane dusky translucent, strongly iridescent; legs and beak dark reddish-brown. Head porrect; clypeus stout, its apex obtuse; ocelli small, separated by four times their diameters; beak stout, apparently 3-jointed, reaching front coxae, its apical joint acute, decurved. Antennae black, about as long as head and thorax, bristly pubescent; joint 1 not reaching tip of tylus; 3 and 4 subequal, 3 two-thirds the length of 2. Pronotum with apex and base truncate; collar distinct, prominent; disk very finely transversely rugose, rather thickly pubescent with very fine suberect blackish hairs; scutellum feebly convex, glabrous, finely transversely rugose. Elytra conjointly narrowly oval, surpassing abdomen by three-fourths the length of membrane; sides straight and parallel to base of cuneus, thence gradually curved into the strongly rounded tips; disk very finely pubescent. Hind tibiae curved, one-half longer than femora; tarsi 2-jointed, joint 2 more than twice the length of 1. Length 1.5 mm.

Type a female, taken March 10, 1927, at Dunedin, Florida, by beating the foliage of water oak. The much narrower form of body, different relative length of antennal joints, different shape of pronotum, etc., distinguish this unique form from *Mallochiola gagates* M. & M.

Making Insect Labels with the Camera.

By W. A. HIESTAND, University of Wisconsin,
Madison, Wisconsin.

Very satisfactory locality and ecology labels may be made by using a focusing camera and a typewriter. The illustrations below show examples of labels which were typed on white paper, photographed with a focusing camera and printed on Regular Azo paper. One desirable feature of making labels in this manner is the fact that their size may be regulated to suit the user. If smaller type is desired than that shown in the illustration it is only necessary to have the typewritten sheet farther from the camera and vice versa for larger type. Needless to say it is advantageous for the collector to be able to print out whatever number of labels he needs and to arrange their composition to suit his taste. Very often the situation arises when it is well to have labels



in small quantities from various localities and the expense of having them printed is high, due to the fact that it is often difficult to obtain them in quantities of less than five hundred of a kind.

The following directions should serve to explain the method of making the labels. First of all it is necessary to use a typewriter with a new black record ribbon as clearness in the copy sheet is desirable. Of course the clearer the typewritten sheet the clearer will be the negative made from it. Several sheets may be photographed at a single exposure depending upon the size of the plate of the camera. I have found that the best results were obtained by exposing the sheets to the camera by artificial light. I use two fifty watt mazda bulbs in two reading lamps and give the film an exposure of three minutes. It is necessary to use a focusing camera with a ground-glass plate in order that the lens may be put in sharp focus and also that the size of the labels may be regulated. I have met with best results when the iris diaphragm of the camera was set between stops 8 and 16. The sheet to be copied should be pinned onto a backing of some sort so that it will be in a plane parallel to the film or plate of the camera. I have found that it is desirable to have the background of white material like the sheet itself rather than darker as the light from the lamps will be more evenly diffused. I have often noticed that the labels in the center of the film were clearer than those at the edges and have traced this defect to the dark background. Since I have used a white background I have not had this trouble. It is necessary to use a "Process" film or plate in copying the labels in order to get the greatest contrast possible and hence the sharpest labels. Care should be taken in developing the film or plate to insure sufficient development for if either is not left long enough in the fixing bath the resulting labels will not be distinct. Personally, I leave the film in the developer until it becomes so dark that I can no longer make out any characters upon it. In this way I get best results. In printing, the orthodox rules may be followed with good results. I have found that Azo paper, grade number 2, works quite well. A longer exposure than usual is necessary in printing out the labels because of the greater degree of contrast desired. It is well to leave the

prints in the fixing bath for some time to insure their permanent character.

There is no reason why a collector who has access to a focusing camera can not make satisfactory labels for his coltion at a considerable saving of expense. The greatest advantage of photographic labels lies in the fact that whatever number needed may be printed and their exact composition made to suit the collector. A great variety of ecological labels can be easily made for different occasions by this means.

Hesperia eos Edwards (Lep.: Hesperiidae).

By A. W. LINDSEY, Denison University, Granville, Ohio.

The standing of *Hesperia eos* Edwards in our faunal lists has been open to question for many years. It was merely listed by Skinner (Syn. Cat. p. 91, 1898) and Dyar (List. N. A. Lep. 47, 1902) as a species of *Amblyscirtes*. McDunnough associated it with *celia* Skinner and *meridionalis* Dyar (Contributions iii, 137, 1916) but in the Barnes and McDunnough Check List of 1917 separated the three names. Finally McDunnough placed *eos* and *meridionalis* as synonyms of *alternata* G. & R., an arrangement which I retained in my generic revision of the family. This classification is continued by Barnes and Benjamin in their latest check list of the North American diurnals.

During my connection with the Barnes collection a careful perusal of the original description of *eos* led me to the belief that the species was really the same as *comus* Edw., with which it had never, to my knowledge, been associated. Until recently I have been unable to verify this conclusion, but an examination of the material in the Cambridge Museum shows that it was correct.

The museum collection, in which the type was said by Edwards to be located, now contains two specimens labelled as types of *eos*. One is a male of *alternata*, the other a female of *comus*. The original description mentions a male, but gives no exact information as to the number of specimens in the type series. According to Edwards' usual procedure, his state-

ment would lead one to expect a single male type, but the appearance of the sexes in *Amblyscirtes* is such that they cannot readily be separated by superficial examination. The two specimens in the Cambridge Museum are not conclusive in accessory details, for both bear printed locality labels reading "Dallas Tex Boll".

In their work on the genitalia of the North American species of Hesperioidea Skinner and Williams indicate that they have examined these types, and say that they believe "*eos* falls to *alternata*." They refer the other type to *comus*, saying that it is a male, and thus unwittingly furnish evidence for my belief that Edwards himself made a mistake in the sex of this type.

We cannot fail to consider original descriptions in the ultimate fixation of species. In the present case a comparison of the specimen of *comus* with Edwards' description shows exact agreement in the distribution and number of spots. Needless to say, the other specimen labelled type contrasts strongly, for *comus* has well defined white spots on the under surface of the secondaries and well marked preapical spots on the primaries, while in *alternata* no spots are well defined and the under surface usually bears only the vaguest indication of spots, due to a slight concentration of the superficial gray vestiture. It seems incredible that such a practiced eye as Edwards' could have included the two specimens in the same series; it is certainly impossible for his description to apply to the specimen of *alternata*.

In discussing the disposition of the name, Mr. Banks has suggested a logical course if the two specimens must be regarded as types. *Alternata* was described before *eos*, hence when *eos* was described one specimen belonged to a described species, and in the absence of an absolute indication of the type, would automatically be dropped in favor of the remaining specimen. This would fix the specimen of *comus* in the Cambridge Museum as the type of *eos*. Fortunately all of the facts in the case favor this course.

The following bibliography shows the corrected synonymy and includes the chief references to the species concerned.

Amblyscirtes eos Edwards.

Hesperia eos Edw., Trans. Am. Ent. Soc. iii, 276, 1871.
Hesperia comus Edw., Trans. Am. Ent. Soc. v, 206, 1876.
Amblyscirtes niusl Edw., Field and Forest iii, 118, 1878.
Pamphila comus Skinner, Syn. Cat. 90, 1898.
Stomyles comus Godman & Salvin, Biol. Cent. Am., Rhop. ii, 502, pl. 95, fig. 25, 26, 1900.
Amblyscirtes eos Dyar, List N. A. Lep. 47, 1902.
Euphyes comus Dyar, op. cit. 53, 1902.
Pamphila quinquemacula Skinner, Ent. News xxii, 413, 1911.
Amblyscirtes comus Barnes & McDunnough, Check List 22, 1917.
Lindsey, Hesp. N. A. 101, 1921.
Skinner & Williams, Trans. Am. Ent. Soc. xlix, 141, fig. 23, 1923.
Barnes & Benjamin, List Diurn. Lep. 25, 1926.

Amblyscirtes alternata Grote & Robinson.

Hesperia alternata G. & R., Trans. Am. Ent. Soc. i, 3, 1867.
Amblyscirtes meridionalis Dyar, Jn. N. Y. Ent. Soc. xiii, 135, 1905.
Amblyscirtes alternata Barnes & McDunnough, Check List 22, 1917.
Lindsey, Hesp. N. A. 101, 1921.
Skinner & Williams, Trans. Am. Ent. Soc. xliv, 138, fig. 18, 1923.
Barnes & Benjamin, List Diurn. Lep. 25, 1926.

On Three Chilopods from the La Sal Mountains of Utah.

By RALPH V. CHAMBERLIN, University of Utah, Salt Lake City, Utah.

The material upon which these notes are based was submitted to me for study by Dr. V. M. Tanner by whom the specimens were colleceted in July, 1927. All were taken in the faunistically little known La Sal Mountains of San Juan Co., Utah. In addition to the chilopods, there was in the material collected a male of the diplopod *Paraiulus venustus*

(Wood), a form not previously taken in Utah, although not uncommon in Colorado and New Mexico.

The types of the new species are in the author's collection.

Lophobius lasalanus sp. nov.

Dorsum light chestnut brown, the head scarcely deeper in color than the dorsal plates. Antennae usually concolorous with head, a little paler at tips. Legs a little lighter than antennae. Antennae short, composed of twenty articles. Ocelli few, mostly in two series; e. g., 1+4, 3. Prosternal teeth 2+2.

Third joint of all anterior legs excepting those of first pair with 2 ventral spines. Ventral spines of first legs 1, 3, 1. Penult legs with ventral spines 1, 3, 3, 2 or 1, 3, 3, 3. Anal legs with two claws; ventral spines 1, 3, 3, 1 or 1, 3, 3, 0. Last two pairs of coxae armed laterally, the last three pairs dorsally. Anal legs of male without lobes.

Claw of female gonopods tripartite; basal spines 2+2.

Length, up to 11 mm.

This species is differentiated from all others in the genus excepting *L. socius* in possessing 2 claws on the anal legs. It is readily distinguished from *socius* in having the ventral spines of the anal legs 1, 3, 3, 1 or 1, 3, 3, 0 instead of 1, 3, 2, 1, in not having the fourth joint of the anal legs modified in the male, in the fewer ocelli, and smaller size.

The species now known in the genus may be separated by means of the following key.

Key to Species of Lophobius.

a. All anterior legs, or all but first 1 or 2 pairs, with third joint bearing 2 ventral spines.
  b. Ventral spines of penult legs 0, 1, 3, 3, 2.
    c. Anal legs armed with 2 claws.
      d. Ventral spines of anal legs 1, 3, 3, 1(0); ocelli in 2 series.....*lasalanus*, sp. nov.
      dd. Ventral spines of anal legs 1, 3, 2, 1; ocelli in from 3 to 5 series....*socius* Chamberlin
    cc. Anal legs with claw single.
      d. Dorsal spines of twelfth legs 1, 0, 3, 1, 1.
        e. Ventral spines of anal legs 1, 3, 2, 0; of the twelfth and thirteenth 0, 3, 3, 2 *collium* Chamberlin
        ee. Ventral spines of anal legs normally 1, 3, 2, 1.
          f. Last article of anal legs furrowed along mesal side; fourth joint in

male with a conspicuous distal lobe above.....*franciscae* Chamberlin

ff. Anal legs unmodified in both sexes.....*pungonius* Chamberlin

dd. Dorsal spines of twelfth legs 1, 0, 3, 2, 2 or 1, 0, 3, 1, 2.

e. Ventral spines of anal legs 1, 3, 2, 1; head a little longer than wide *arizonae* Chamberlin

ee. Ventral spines of anal legs normally 1, 3, 2, 0; head wider than long. *helenae* Chamberlin

bb. Ventral spines of penult legs 0, 1, 3, 3, 1 (lobe at distal end of fourth joint in male conspicuous) *castellopes* (Chamberlin)

aa. First seven pairs of legs with the third joint bearing but a single ventral spine.....*eremus* Chamberlin

Watophilus utus, sp. nov.

Cephalic plate long, widest anteriorly, the sides converging to the caudal end; anterior and posterior corners rounded; anterior margin forming a very obtuse angle at middle. Frontal suture not evident.

Cephalic plate overlapping the basal plate, covering about one third of its total length. Basal plate with a transverse row of setae behind middle of its exposed portion.

A single small clypeal area present on middle line a little caudad of level of insertion of antennae.

Labrum with lateral pieces separated by a district middle piece which bears on its caudal edge about ten long, slender, caudally directed teeth.

Claws of prehensors when closed equalling or a little surpassing the distal end of the first antennal article. Claw of prehensors with a small rounded tooth at base; the two preceding joints with inconspicuous or obsolete rounded nodules; femuroid also with one at distal end, excavated a little proximad of the tooth.

Spiracles all circular; the first large, the second abruptly smaller and the succeeding ones decreasing gradually caudad.

Anal legs clawless, the claw replaced by a minute membranous article; terminating in several stout setae.

Last ventral plate wider than long, the caudal margin convex. Coxopleural pores 3 or 4 along ventral plate, or partly covered by latter, and 2 or 3 above adjacent to last tergite.

Anal pores present.

Pairs of legs in female, 65.

Length, 21 mm.

The species of this genus have the number of pairs of legs usually invariable, or practically so, for each sex. The species are thus in most cases easily separated on this basis. The present species has a larger number of pairs than any species previously known, the nearest being *W. laetus* Chamberlin of California which has a maximum of 55 pairs.

GNATHOMERIUM XENOPORUS (Chamberlin) In the collection is one specimen of this species which is a common form under leaves along canyon streams in the Wahsatch Mountains, but which occurs as well in Colorado and New Mexico.

Insects made of Metal.

INSECTS made of metal, true to the originals in the last minute details of structure, are produced by a process discovered by Dr. N. D. Zelinsky, a German chemist. As a matter of fact, the insects themselves are metallized through a replacement of their original substance with the metal, just as the details of wood or leaf structure are replaced with stone in petrifactions. The process was discovered by a quasi-accident. Dr. Zelinsky had undertaken to make chemical analysis of some insects. The procedure involved covering them with finely powdered copper oxid and heating them in small platinum crucibles under an atmosphere of carbon dioxid. At the end of the treatment he found to his astonishment that he had a collection of perfect copper insects, for the outer parts of their body-shells had been penetrated by the metal and the original horny chitin, with all its fine markings, was replaced by a layer of copper. It is thought that this method may be of value in museums in the permanent preservation of rare and perishable insect specimens, and possibly plants as well.—Science Service in *Science* for Dec. 23, 1927.

The Monarch Butterfly Wintering in the Everglades (Lepid.: Danaidae).

The annual migrations of the Monarch Butterflies (*Danaus menippe* Hübner [*Anosia plexippus* Linn.]) have been the source of considerable scientific interest. The paths of migration have been definitely traced for part of their routes, but it has been a matter of some conjecture where the majority spend the winter.

In January, 1924, during the writer's trip through the Everglades, between West Palm Beach and Lake Okeechobee,

great numbers of Monarch Butterflies were noted flying over the saw grass, alighting on flowers, etc. Mating was observed in several instances. The possibility that these great numbers of butterflies represented the local population must, of course, be considered, but it seems much more probable that these vast throngs of butterflies were the migrants in their winter quarters.—S. W. BROMLEY, New York.

Entomological Literature

COMPILED, WITH THE ASSISTANCE OF "BIOLOGICAL ABSTRACTS," UNDER THE SUPERVISION OF E. T. CRESSON, JR.

Under the above head it is intended to note papers received at the Academy of Natural Sciences, of Philadelphia, pertaining to the Entomology of the Americas (North and South), including Arachnida and Myriopoda. Articles irrelevant to American entomology will not be noted; but contributions to anatomy, physiology and embryology of insects, however, whether relating to American or exotic species will be recorded.

The numbers **within brackets** [ ] refer to the journals, as numbered in the list of Periodicals and Serials published in the January and June numbers (or which may be secured from the publisher of Entomological News for 10c), in which the paper appeared. The number of, or annual **volume,** and in some cases the part, heft, &c. the latter **within** ( ) follows; then the pagination follows the **colon** :

All continued papers, with few exceptions, are recorded only at their first installments.

*Papers containing new forms or names have an * preceding the author's name.

(S) Papers pertaining exclusively to neotropical species, and not so indicated in the title, have the symbol (S) at the end of the title of the paper.

For records of Economic Literature, see the Experiment Station Record, Office of Experiment Stations, Washington. Also Review of Applied Entomology, Series A, London. For records of papers on Medical Entomology, see Review of Applied Entomology, Series B.

☞ *Note the change in the method of citing the bibliographical references, as explained above.*

Papers published in the Entomological News are not listed.

GENERAL.—Andrews, E. A.—Injuries to vegetation by mound building ants. [90] 62: 63-75. **Bott, R.**—Die Flugbewegung der Insekten. [18] 21: 176-178. **Common** names of insects approved for general use by American association of economic entomologists. (Second Supplement) [12] 20: 837-839. **Godfrey, E. J.**—Migrations of butterflies in Siam with some remarks on migrations in general. [Jour. Siam Soc. N. H.] 7: 93-100. **Grabe, A.**—Das Etikett. [18] 21: 255-258, ill. **Graves, P. P.**—Nomenclature, Dr. Verity, etc. [21] 39: 167-169. ***Hedicke, H.**—Aus der entomologischen Welt. (S) [11] 1927: 235-237. **Heydemann, F.**—Der Gebirgs-und Küsten-Melanismus und-Nigrismus. Zugleich ein Beitrag zur Frage des Industrie-Melanismus. [18] 21: 247-252, cont. **Knaus, W.**—Letter from a pioneer Kansas entomologist. [Jour. Kansas Ent. Soc.] 1: 19-23. **Lizer y Trelles, C. A.**—

Apuntaciones para la Bibliografia entomologica argentina. [Physis, Buenos Aires] 8: 505-535. **McAtee, W. L.**—Bird nests as insect and arachnid hibernacula. [10] 29: 180-184. **McColloch, J. W.**—A list of the literature on Kansas Arthropoda. [Jour. Kansas Ent. Soc.] 1: 3-19. **Meissner, O.**—Kurze Bemerkungen über einige neuere naturwissenschaftliche Theorien. [20] 42: 45-46, ill. **Müller, L.**—Der Fundzettel. [18] 21: 279-281. **Schultz, V. G. M.**—Vögel auf der Falterjagd. [18] 21: 123-125.

ANATOMY, PHYSIOLOGY, ETC.—Cretschmar, M.—Pilzsymbiose und verwandte Erscheinungen bei Insekten. [18] 21: 241-244, cont. **Demoll, R.**—Untersuchungen über die Atmung der Insekten. [Zeit. f. Biologie] 87: 8-22, ill. **Fischer, E. et P.**—Observations et expériences sur les évolutions des mouches pendant le vol les réactions au mouvement. [78] 61: 397-427. **Koch, A.**—Methoden zur Behandlung der Atemphysiologie der Insekten. [Handb. Biol. Arbeitsm.] Lief. 199: 135-214, ill. **Kunze, G.**—Einige Versuche über den Geschmackssinn der Honigbienne. [89] (Zool. u. Phys.) 44: 287-314. **Lloyd, L.**—Salivary Secretions of Blood-sucking Insects in Relation to Blood Coagulation. [31] 121: 13. **Morita, J.**—Les chromosomes dans la deuxième cinèse spermatocytaire de "Mecostethus grossus". [78] 61: 428-432, ill. **Morrison, T. F.**—Animal light, with special reference to the synchronous flashing of fireflies. [Jour. Siam. Soc. N. H.] 7: 71-81. **Muir, F.**—The evidence for Hybrid Vigour in Insects. [31] 121: 56. **Pawlowsky, u. Stein.**—Experimentelle untersuchungen über die wirkung der gifthaare der überwinternden goldafterraupen (Euproctis chrysorrhoea) auf die menschenhaut. [46] 9: 615-637, ill. **Prochnow, O.**—Die Verfahren zur Erforschung des Tierfluges. [Handb. Biol. Arbeitsm.] Lief. 199: 215-294, ill. **Schuster von Forstner, W.**—Licht ohne Wärme! Die neuesten Forschungsergebnisse über die Lampyriden. [20] 42: 43-44. **Tirelli, M.**—Studi sulla Fisiologia del sistema nervoso degli Insetti. [Bol. Isst. Zool. Roma] 5: 84-114, ill. **Whiting, A. R.**—Genetic evidence for diploid males in Habrobracon. [90] 62: 55-58. **Whiting, P. W.**—The relation between gynandromorphism and mutation in Habrobracon. [90] 62: 59-62. **Wülker, G.**—Nahrungsaufnahme und Stoffwechsel bei blutsaugenden Insekten. [18] 21: 311-314, ill. **Zeleny, C.**—Non-inheritance of the temperature effect on bar eye in Drosophila m. [90] 62: 88-90.

ARACHNIDA AND MYRIOPODA.—*Leitão, M.—Generos novos de Gonyleptideos. (S) [Bol. Mus. Nac. R. d. Janeiro] 3: 13-22. **Taylor, R. L.**—Notes on the mite Pediculoides ventricosus Newport. [5] 34: 157-163, ill.

THE SMALLER ORDERS OF INSECTA.—*Folsom, J. W.—Insects of the subclass Apterygota from Central America and the West Indes. (S) [50] 72, Art. 6: 1-16, ill. **Heikertinger, F.**—Züchtung von Neuropteren Trichopteren und Panorpaten (Mecopteren). [Handb. Biol. Arbeitsm.] Lief. 204: 271-275. ***McDunnough, J.**—A new Heptagenia from the Yellowstone region. [4] 59: 261-265. **Rabaud, E.**—Etude biologique des larves de quelques Planipennes. [78] 61: 433-499, ill.

HEMIPTERA.—Börner, C.—Züchtung der Homopteren. [Handb. Biol. Arbeitsm.] 204: 215-270, ill. ***Hungerford, H. B.**—A report upon the aquatic and semi-aquatic hemiptera of the Mulford Biological expedition to Bolivia, South America, 1921-22. [10] 29: 187-190, ill. ***Jensen, H. A. C.**—Hemipterological notes and descriptions. IV. (S) [42] 16: 41-56. **Soliman, L. B.**—A comparative study of the structural characters used in the classification of the genus Macrosiphum of the family Aphididae with special reference to the species found in California. [67] 4: 89-158, ill. **Van Duzee, E. P.**—A Rare Aradid. [55] 4: 68

LEPIDOPTERA.—Barnes & Benjamin.—On the identity of Acidalia hepaticaria. (Geometridae). On the identity of "Cosmia" orina. Phalaenidae). [55] 4: 89; 89. **Blasche, P.**—Bequemer Nachtfang. [18] 21: 131-134. **Fischer, E.**—Züchtung der Lepidopteren. [Handb. Biol. Arbeitsm.] Lief. 204: 277-356, ill. **Johnson, C. W.**—Notes on the present distribution of two introduced moths. [5] 34: 176-177. **Learned, E. T.**—A study of the male abdominal appendages of the Nais-group of Apantesis-Walker. (Arctiidae) [5] 34: 135-145, ill. ***McDunnough, J.**—Contribution towards a knowledge of our Canadian plume moths. [Trans. R. Soc. Canada] Sect. 5, 21: 175-188, ill. ***McDunnough, J.**—The Lepidoptera of the Seton Lake region, British Columbia. [4] 59: 266-277. ***Meyrick, E.**—Exotic Microlepidoptera. (S) [52] 3: 321-384. **Michael, H.**—Die Zucht des chinesischen Seidenspinners Bombyx mori. [Handb. Biol. Arbeitsm.] Lief. 207: 537-

556, ill. ***Neustetter, H.**—Neue Heliconius-Formen. (S) [18] 21: 227-230. ***Niepelt, W.**—Neue exotische Rhopaloceren. (S) [18] 21: 180-182, ill. ***Niepelt, W.**—Neue Falter von Columbien. (S) [18] 21: 239-241. ***Niepelt, W.**—Neue Rassen von Morpho theseus Deyr. (S) [18] 21: 252-253, ill. ***Przegendza.**—Aberrationen von Callicore clymena Cr. und Catagramma hydaspes Drury. (S) [14] 41: 333-335, ill. ***Röber, J.**—Neue exotische Falter. (S) [18] 21: 140-142, ill. ***Röber, J.**—Neue exotische Falter. (S) [18] 21: 197-198. ***Röber, J.**—Neue exotische Falter. (S) [18] 21: 281-282. ***Schaus, W.**—New species of Heterocera from Central and South America. [10] 29: 185-186. ***Strand, E.**—Nordamerikanische, inbesondere californische Lepidoptera. [52] 1914, Abt. A, Hft. 11: 151-163. [n. sp. of Papaipema and Dysocnemis]. **Voukassovitch, P.**—Observations biologiques sur Vanessa io et ses parasites. [25] 1927: 277-278.

DIPTERA.—*Aldrich, J. M.—Redescription of types of American Muscoid flies in the collection of the Vienna natural history museum with incidental notes. (S). [50] 72, Art. 7: 35 pp. ***Curran, C. H.**—Some new Canadian Scatophagidae. [4] 59: 253-261. ***Curran, C. H.**—Synopsis of the Canadian Stratiomyidae. [Trans. R. Soc. Canada] (Sect. 5) 21: 191-228. **Heikertinger, F.**—Züchtung von Dipteren. [Handb. Biol. Arbeitsm.] Lief. 204: 357-398. **Malloch, J. R.**—Descriptions and figures of the puparia of Minettia ordinaria and Caliope flaviceps. [10] 29: 184, ill.

COLEOPTERA.—Bruch, C.—Suplemento al catalogo sistematico de los Coleopteros de la Republica Argentina. [Physis, Buenos Aires] 8: 536-553. **Darlington, P. J.**—Helophorus aquaticus L. in America. [5] 34: 174-175. **Heikertinger, F.**—Züchtung von Coleopteren. [Handb. Biol. Arbeitsm.] Lief. 204: 399-458, ill. **Horn, W.**—Ueber "Monstrositäten" und verwandte Vorgänge bei Cicindelinen. [49] 16: 471-477, ill. ***Luederwaldt, H.**—Cinco novas especies da familia dos Passalideos. (S) [Bol. Mus. Nac. R. d. Janeiro] 3: 37-38. **Salt, G.**—Notes on the Strepsiptera and their hymenopterous hosts. [5] 34: 182-192. **Scheerpeltz, O.**—Ein einfaches Hilfsmittel zur Präparation des Oedeagalapparates bei Koleopteren. [79] 13: 246-251, ill. **Van Dyke, E. C.**—Uncommon Buprestidae. [55] 4: 95. **Wilhelm, O.**—Calosoma sycophanta als Bienenfeind. [18] 21: 187. **Wilson, J. W.**—The male genital tube of

some of the species of the genus Scymnus (Coccinellidae). [5] 34: 167-170, ill.

HYMENOPTERA.—Arnold, J.—Beobachtungen über Hornissenvölker. [18] 21: 135-136. **Fahringer, J.**—Züchtung von Hymenopteren. [Handb. Biol. Arbeitsm.] Lief. 204: 458-484, ill. ***Fouts, R. M.**—Descriptions of new nearctic Serphoidea [10] 29: 165-179, ill. **Hartmann, M.**—Haltung und Zucht der Honigbiene. [Handb. Biol. Arbeitsm.] Lief. 207: 513-536, ill. ***Gahan, A. B.**—Description of a new Eulophid parasitic on Bucculatrix canadensisella Chambers. [5] 34: 171-173. **Götze, G.**—Untersuchungen an Hymenopteren über das Vorkommen und die Bedeutung der Stirnaugen. [89] (Zool. u. Phys.) 44: 211-268, ill. **Kutter, H.**—Züchtung von Ameisen. [Handb. Biol. Arbeitsm.] Lief. 207: 485-512, ill. ***Mitchell, T. B.**—Notes on the Megachilidae. [5] 34: 178-181. **Stärcke, A.**—Beginnende Divergenz bei Myrmica lobicorins Nyl. [30] 70: 73-84. 4 fig. ***Turner, R. E.**—On a new Thynnid wasp from Paraguay. (S) [49] 16: 449. **Wheeler, W. M.**—The occurrence of the pavement ant (Tetramorium caespitum L.) in Boston. [5] 34: 164-165.

SPECIAL NOTICES.—Opuscula braconologica.—Von Professor Dr. Josef Fahringer in Wien. Band I. Palaearktische Region. This monographic work may be of interest to American students.

Zoology of Colorado. By Theodore D. A. Cockerell, Professor of Zoology in the University of Colorado. Published by the University of Colorado, Boulder, Colorado, 1927. 12 mo., pp. viii, 262, illustrated.—A fly leaf reads: "University of Colorado Semicentennial Publications Authorized by the Board of Regents of the University of Colorado and prepared under the supervision of a committee of the Faculty . . . . these five volumes are issued as part of the celebration of the Semicentennial of the University, November, 1927. They will be of interest primarily to the people of this State and are appropriately Dedicated to The Citizens of Colorado."

Prof. Cockerell has divided this, the third volume of the series, into fourteen chapters, entitled, respectively: 1. The Past, 2. Mammals, 3. Birds, 4. Reptiles, 5. Amphibia, 6. Fossil Fishes, 7. Living Fishes, 8. Mollusca, 9. Insects, 10. Butterflies, 11. Moths, 12. Crustacea, 13. Worms, 14. Protozoa. The relations between the extinct and living faunas are pointed out in almost every chapter. Chapter 9 occupies

pages 143-208, the Butterflies and the Moths receive 15 and 9 additional pages respectively. In each chapter the most common, or otherwise noteworthy, members of the group discussed that occur in Colorado are mentioned or briefly described, and many hitherto unpublished details and critical remarks will be found in the readable text. There is an alphabetical index of eight pages. The opportunities for discovery of new forms, habits and habitats offered by the rich fauna o' this State are frequently brought to the attention of the reader. For the resident and the traveler in Colorado the book should be a great boon.—P. P. CALVERT.

OBITUARY.

FRANK R. MASON died on May 28, 1927, in his forty-sixth year, at his residence, 5533 Pulaski Avenue, Germantown, Philadelphia, Pennsylvania.

When about twelve years old he first showed signs of being interested in insects, especially moths attracted to the electric lights. Several years later he commenced his first collection consisting of butterflies and moths. Tiring of these he became more and more interested in beetles and finally disposed of all his Lepidoptera and settled down to the stupendous but pleasant task of making as complete a collection of the Coleoptera of the world as possible.

The first big addition to his cabinet came with the purchase of the Cerambycidae of the famous Vanderpole collection of Europe. The material was safely transported to Philadelphia and contained many types and thousands of interesting specics from all parts of the world. Meanwhile he was steadily increasing his staff of collectors in every country. Much of the duplicate material he was able to exchange to advantage. He also purchased the collection of Mr. George Angell. This consisted of probably the finest collection of *Cychrus, Carabus,* and *Calosoma* of the world ever made by an American.

He took unusual pride in the neatness and appearance of his beetles. The specimens were kept in wooden boxes slightly larger than the regulation Schmitt box. Metal cases were constructed just to hold these boxes. A large room was

set aside solely for the collection. All his mounting, packing, and other work was done in a separate building equipped for the purpose. He would not tolerate a locality or date label written by hand and had a printing press in order to enhance still further the appearance of each specimen.

Although interested primarily at first in the Longicorns, he also collected beetles of the other families. His favorites were the Buprestidae, Scarabaeidae, Carabidae and weevils or Rhynchophora. The last few years his collection had grown so rapidly that he decided to dispose of certain obscure, or to him uninteresting, groups such as Staphylinidae, water beetles, etc.

At the time of his death he had undoubtedly the best collection of beetles of the world in this country. His material is now in The Academy of Natural Sciences in Philadelphia. In accordance with his will and wishes it will be kept intact, but is open for the inspection of all students to whom it can not fail to be a great help and inspiration.

He never displayed much interest in writing on entomological topics. Neither was he interested in obtaining a library on the subject except where it would help him in arranging his beetles. Although very fond of being out in the field, he was not a diligent or hardworking collector and readily admitted it. The correspondence with his numerous scientific friends gave him untold pleasure and his premature and sudden passing brought sorrow to many.

Frank R. Mason, son of Henry and Emma Mason, was born February 23, 1882, at Germantown, Philadelphia. He was a delicate child and only attended Germantown Academy a short time, most of his education being obtained from a tutor. At the age of sixteen he entered the biological course at the University of Pennsylvania but on account of poor health did not complete the first year. Later he accepted a position in Mexico, but again his health interfered and he remained only six months, but long enough to do some collecting. He travelled quite extensively and besides making six trips to Europe also visited Northern Africa, South America

and Hawaii, and had been in every state of the United States except two.

The writer regarded him as one of his best and dearest friends. Many pleasant collecting trips were enjoyed in his company. The mountains of Tennessee and Virginia were explored together. The White Mountains of New Hampshire were visited twice; also Fairfax County, Virginia, on many occasions, as well as innumerable localities in the states of New York and New Jersey. Even on the day of his sudden death, from a blood clot formed near the brain, he was to have been with a party of friends collecting at Point Pleasant, New Jersey. Word of his being taken was received upon the writer's return from this trip and the following day he sadly went to Philadelphia to the funeral of his good friend whose irreparable friendship he will never be able to replace.

ALAN S. NICOLAY.

Mr. Mason's collection is especially rich in the exotic species, but does not exhibit its value alike in all the families. This is, however, compensated for by the large series in the families in which he was especially interested. Among these may be mentioned the Cicindelidae with 372 species, Carabidae with 2,338, Meloidae with 238, Pselaphidae, 194, Cleridae, 100, Elateridae, 410, Buprestidae, 1,733, Tenebrionidae, 591, Scarabaeidae, 1,636, Lucanidae, 99, Cerambycidae, 4,660, Chrysomelidae, 1,593, Platystomidae, 259, Coccinellidae, 121, Curculionidae, 1,336.

In all the collection is represented by 53 families, 16,863 species and about 76,650 specimens, and is contained in over 1,100 boxes, in nine large pest-proof steel cabinets. The collection of the family Carabidae alone contains about 10,200 specimens and is, as regards the exotic species, considered to be one of the most important and complete in the country. The fine condition of the material, together with the excellent technique exhibited in the mounting and arrangement, gives it an exceptionally handsome appearance and great value.

E. T. CRESSON, JR.

EXCHANGES

This column is intended only for wants and exchanges, not for advertisements of goods for sale. Notices not exceeding three lines free to subscribers.

These notices are continued as long as our limited space will allow; the new ones are added at the end of the column, and only when necessary those at the top (being longest in) are discontinued.

Wanted—For cash or exchange—Entomological News, Vols. 8, 9, 10, each complete, and Vol. 11, No. 5; Psyche, Vol. 11, Nos. 1, 3, 4; Vol. 13, Nos. 2, 3, 4; Vol. 14, No. 6; Vol. 16, Nos. 1, 5, 6. Many good items for exchange.—J. E. Hallinen, Cooperton, Okla.

For Exchange—Lepidoptera of Georgia for those from other states and countries. Send lists to A. G. Richards, Jr., 498 Prince Ave., Athens, Ga.

Cash for Back Issue—Wanted December issue, Vol. 2, 1891, Ent. News. Name your price; or will buy complete Vol. 2. Mr. J. D. Gunder, 849 Linda Vista Ave., Pasadena, Calif.

Wanted—Living cocoons of American Silk Moths: Luna, Cecropia Polyphemus, etc. Offered: Morphos, etc., in exchange or cash. Send particulars before sending.—A. Ford, 42, Irving Road, Bournemouth, Hampshire, England.

For Exchange—A large number of living cocoons of Actias selene, Philosamia cynthia, etc., in winter. Send for list.—Vee Kung Yu, c/o Bureau of Entomology, Kashing, Chekiang Province, China.

Wanted—Specimens of the genus **Pepsis** (Tarantula hawks) for a revision of the genus. Will name and return. H. T. Fernald, Amherst, Mass.

For Exchange—South American and Celebes butterflies by 100 monthly arrivals, also South and North American pupae and cocoons. Mrs. Emma Kessler, 499 Manhattan Ave., New York.

Exchange—Northern Idaho Lepidoptera to exchange for exotics or other showy specimens. C. W. Herr, Priest River, Idaho.

Canarian Fauna—For all particulars apply to H. E. Appenhagen, Sta Cruz, Teneriffe, Apartado No. 202.

I am revising the genus *Ceuthophilus* (Orthoptera, Tettigoniidae, Rhaphidophorinae), and will be glad to have material from any part of the country for study and determination. Specimens will be promptly returned.—Theodore H. Hubbell, Museum of Zoology, University of Michigan, Ann Arbor, Michigan.

Lepidoptera from all parts of the world in exchange for rarer Sphingidae, Saturnidae and Bombycidae from the Southern States and Mexico. Send lists of desiderata to Henry Wormsbacher, 1357 St. Charles Ave., Lakewood, Ohio.

Wanted: live pupae of large moths, especially Actias luna, by purchase or in exchange for silkworm eggs.—John H. Gerould, 36 Occom Ridge, Hanover, N. H.

Western Lepidoptera: Sphingidae, Aegeriidae, Cossidae, Catocala and the major Bombycidae in exchange for equally rare species of the same families. Short lists of the *very rare species* only, desired. O. C. Poling, Box 82, Fort Davis, Texas, U. S. A.

Mycetophilidae—Will exchange or identify material in this family. C. F. Adams, Indiana State Board of Health, Indianapolis, U. S. A.

Wanted—"Check List of the Lepidoptera of Boreal America" by Wm. Barnes and J. McDunnough. Kindly quote price. E. J. Dornfeld, 144 North Ave., Milwaukee, Wis.

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GENERAL.

912.—**Cresson** (E. T.)—Ezra Townsend Cresson. A contribution to the history of entomology in North America. By Philip P. Calvert. (Trans. **53**, Suppl., 63 pp., 2 pls., 1928) 1.25

COLEOPTERA

908.—**Chapin** (E. A.).—The North American species of Ptilodactyla (Helodidae). (Trans., **53**, 241-248, 1 pl., 1927)..... .20

LEPIDOPTERA.

904.—**Braun** (A. F.).—Descriptions of new microlepidoptera. (Trans., **53**, 191-199, 1927) ..... .20

910.—**Williams** (R. C., Jr.).—Studies in the neotropical Hesperioidea. Paper 2. (Trans., **53**, 261-291, 2 col. pl., 1927) 1.20

911.—**Jones** (F. M.).—The mating of the Psychidae. (Trans., **53**, 293-312 6 pls., 1927) ..... .55

ODONATA

909.—**Byers** (C. F.).—Key to the North American species of Enallagma with a description of a new species (Zygoptera). (Trans., **53**, 249-260, ill., 1927) ..... .25

ORTHOPTERA.

907.—**Rehn** (J. A. G.).—On new and certain previously known American genera of the Acridinae with specific comments and descriptions. (Trans., **53**, 213-240, 1 pl., 1927) ..... .60

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1500 BUTTERFLIES AND MOTHS, INCLUDING

Papilio columbus
" andraemon
" celadon
" devilliersi
Urania boisduvali
Erinyis guttalaris
Protoparce brontes, etc.

From Venezuela:

Over 5000 Lepidoptera
200 Dynastes hercules

From New Guinea

2000 Coleoptera
200 Orthoptera

From Assam, India:

1200 BUTTERFLIES AND MOTHS, INCLUDING

Papilio arcturus
" philoxenus
Kallima inachis
Brahmaea wallachi

And Many Other Showy Species

From Tibet (Bhutan):

Armandia lidderdalii
Parnassius hardwicki

CATALOGUES OF ENTOMOLOGICAL SUPPLIES AND SPECIMENS ON APPLICATION

If interested kindly send your list of desiderata for further information to

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